capillaries	artries	veins
- recieve blood with O_2 and neutrients from artries and give them to the cells and recieve blood with CO_2 and waste from cells to the veins	- take blood away from the heart	- carry blood back to the heart
- single cell layer of simple squamous epithelium very small thin (no muscles) - no values in the blood capillaries - the place where exchange between blood and tissue - the inner surface of the capillaries is called endothelian. - microscopic vessels surrounds tissues of different organs.	- very thick walls because of the presence of muscles, help in the contraction and relaxation of the artry because the artry push the blood to every part of the body either up or down. - the force comes from the muscles to push the blood. - it has regular circles openings (regular diameter. - the blood moves through artries by contraction and relaxation (recoiling and expansion) - no values in the artries.	- thin walls and contain thin lay of musles. - ~~the blood moves through artries by and relaxation (recoiling - exter~~ - irrigular opinging - not circular. - the blood moves through veins • the help of values (present in large on direction towards the heart. • contraction of skeletal muscles. • the chest suckes the blood so it the blood from down ward to upwa its movement. • (in small blood vessels) the tubular cap • force of the heart contraction wi the blood outside the heart and when it relaxes it shifts the blood. • vescosity of the blood. - not all the veins have values.

1 ②

- the most important factor of maintaining homeostasis the body are the body fluids:
  blood, lymph, urine.
- the inter cellular control is done by the circulatory system, which is composed of:
  - cardiovascular system:
    - consist of the heart and blood vessels.
    - responsible of blood circulation.
    - deliver O_2 and nutrients and takes away wastes.
  - lymphatic system:
    - drains fluids - proteins from the tissue and return them to the blood stream through the thoracic node.
- the interstitial fluid, in the intercellular space is the medium between blood capillaries and the cells.
- lymphatic vessels present beside blood vessels and helps in maintaining homeostasis in the interstitial fluid.
- the contraction of the skeletal muscle moves the blood in all direction through the vein and valves prevent the back flow of the blood and move it in one direction to the heart.
- lymphatic system composed of lymph vessels and lymph nodes

heart: is a muscular pumping organ consists of four Champers and pumps the blood throughout the blood vessels.

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function of the circulatory system:

- Transportation:- of all essential substances for cellular metabolism
  - Respiratory: by RBCs
  - nutritive: from the gut to the liver and body cells
  - excretory: for metabolic waste, excessive water and ions and other molecules in plasma through filtration of the capillaries in the kidney.
- Regulatory function:- by carrying Hormones and other regulatory molecules.
- Protection functions- against:
  - microbes and toxins
  - blood loss
  - WBCs against many disease causing agents.

* the connection between the brain and the heart is not done through the nervous system but through specific electromagnetic waves.

- the heart is the pumping muscular organ located: between lungs, behind sternum slightly to the left.

The heart is divided into four champers:
right and left atria: recieve the blood from the venous syst
right and left ventricles: pump blood into the arterial system.

The right side is separated from the left side ~~through~~ by a muscular wall called septum which prevents blood from mixing.

(4) The structure of the heart :-

- it is surrounded by a membrane is the pericardium which form a sac (pericardial sac) and it has little amount of fluid (pericardial fluid for protection and lubrication.
  act as cushion to prevent it contact with the bones of the ribs.
  pericardial fluid has the same components as the lymph.

The wall of the heart consists of three layers :-
- outer = epicardium
- middle = myocardium
- inner = endocardium.

myocardium: is the real muscle of the heart which is responsible for contraction and relaxation.

- The blood supply to the heart :-
- not from the blood inside it but through blood vessels but it is the first organ that recieve the blood.
- the cornary artry is the first branch of the aorta. in the external heart surface.
  it has two branches : left and right cornary artries which are distributed and reach to every place of the heart.
- the waste products of the heart are drained by the venous system by. left and right cardial vein.
  they retern the blood to the right atrium.
- coronary capillary → coronary venules → cardiac vein
- ~~The heart is the atria~~ the heart chamber's walls are not of the same thickness.
  ventricles have thick walls, atria have thin wall } in order to don't make the heart heavy.

atria's walls are thin because they push the blood to the ventricles (short distance)

The wall of the right ventricle is thinner than the wall of the left ventricle because the right pushes the blood to the lungs (near the heart (short distance)) left side push the blood every where in the body.

heart values :- ~~right~~ ~~Side~~ ① between atria and ventricles are called AV values and ~~the~~ they are :-

right side :- tricepts values (three flaps of tissue are held to the walles of the ventricles with fibers. and moves according to the movement of the ventricles).

left side :- Bicepts (mitral) 2 flaps of tissue.

they are 3 and 2 because the 3 flabs is easier to open.

- the force of the right is lower than the left
- the distance and importance and nearly ~~of~~ all of the blood will reach the aorta.

AV values is opened ~~through~~ to the ventricles.

there is no blood return to the left atrium because the force is more and it the ~~cause~~ values are closed tigthly.

The values are always opened and closed when the ventricles contracts.

80% of the blood in the ~~atria~~ right atrium go to the ventricles with out the need of contraction.

② semilunar values :- in the origin of the pulmonary artry and aorta called (pulmonary and aortic values) they are hilfe moon shaped

- the veins that ~~inter~~ return the heart :
  - vena cava : superiour — upper body; inferiour — lower body

  from the body to the right atrium.

  - pulmonary veins : four veins.
    brings blood from the lungs each lung gives 2 veins and they are the only veins that are allowed to enter the heart.

- the only artry that carry deoxigenated blood is the pulmonary artry.
- the only veins that carry oxigenated blood is the pulmonary veins.

- semilunar valves are called exit valves and prevent the back flow of the blood to the heart.
pulmonary exit the right ventricles and aortic exit left ventricles

Circulations : happens at the same time.

systemic circulation	pulmonary circulation
- far from the heart	- near the heart
- takes oxygenated blood from the left ventricle to all parts of the body (aorta)	- takes deoxygenated blood from the right ventricle to the lungs (pulmonary artry)
- returns de oxygenated blood to the right atrium (venacava)	- returns oxygenated blood from the lungs to the left atrium (4 pulmonary veins)

- ~~the efficiency of~~ the heart efficiencly separates the blood transport into two separated circulatory pathways.

diac cycle:- 3 stages contraction cycle

the whole blood returns to the atria + the contraction of the atria to move the blood to the ventricles

- the contraction of the ventricles to push the blood out of the heart
- a short pause.
- The human heart will undergo over 3 billion contraction cycle.
- when the blood reaches the heart the first step will start.
- The heart is two separated pumping system in the same organ (right and left).

* stroke volume: the amount of blood ejected by contraction of the each ventricle.
* Heart rate: the number of beats per minute.
  in normal adult it is 70 to 72 beats / minute.
* Heart beat: is one complete heart cycle. 0.8 sec.

one heart beat or cardiac cycle includes

- atrial contractions and relaxations
- ventricular contraction and relaxation
- and a short pause.

Heart beat is a contraction and relaxation of the heart muscle

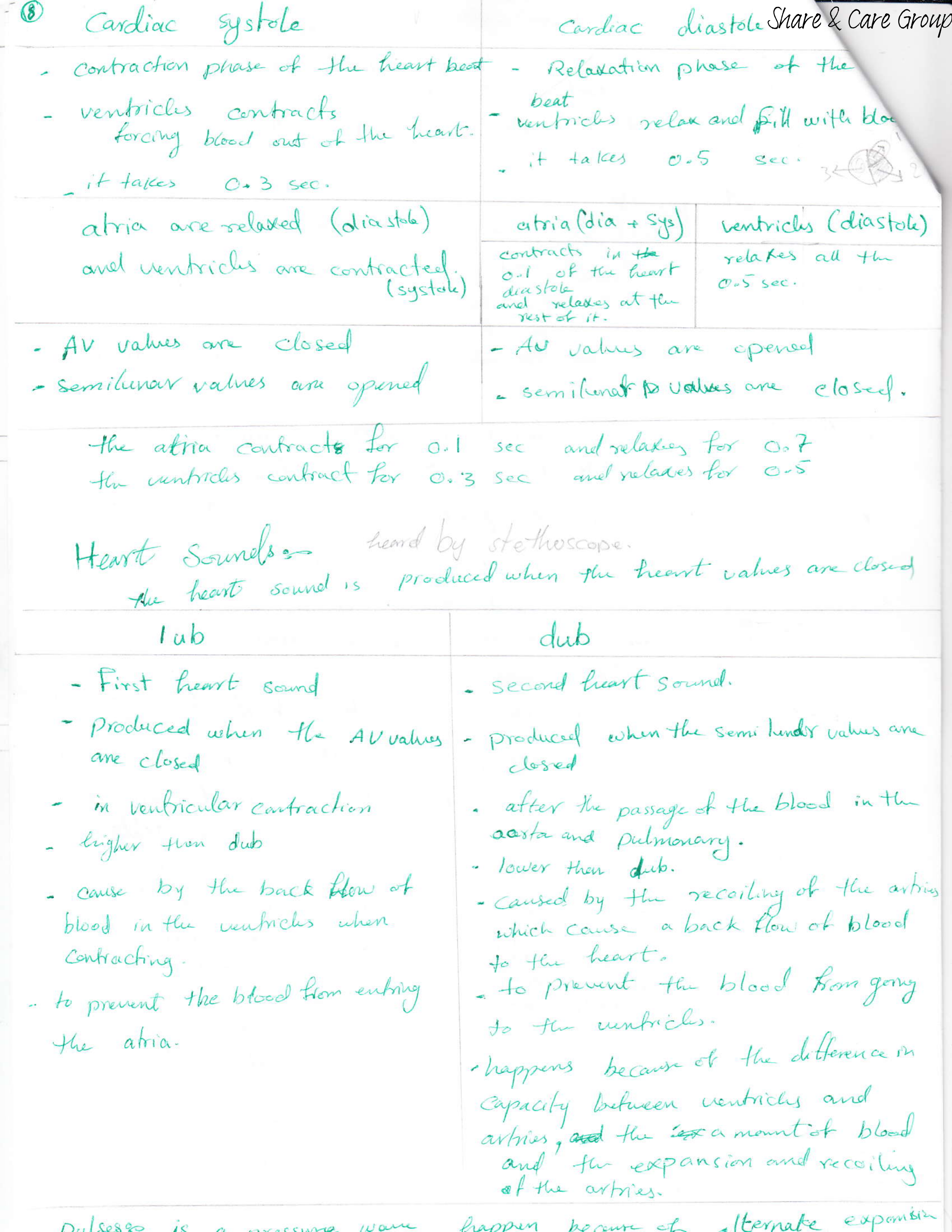
- the short pause is to supply the heart with nutrients and O_2 to start a new cycle.
- beats are different then pulse in that beat can be heard but pulse can not be heard but can be felt.
- heart beats differ according to age and physical activity.
- when the heart beats faster it will use the time of the pause (diastole) (trachy cardia (over 100)) during it the heart rate increase and the number of the heart beats will increase.

0.1 → atrial systole
0.3 → ventricular systole
0.4 → pause

trachy cardia
0.1

more than 100 beats/minute

(... cardia (under 60))



Cardiac systole	Cardiac diastole	
- contraction phase of the heart beat - ventricles contracts forcing blood out of the heart. - it takes 0.3 sec.	- Relaxation phase of the heart beat - ventricles relax and fill with blood - it takes 0.5 sec.	
atria are relaxed (diastole) and ventricles are contracted. (systole)	atria (dia + sys)	ventricles (diastole)
	contracts in the 0.1 of the heart diastole and relaxes at the rest of it.	relaxes all the 0.5 sec.
- AV values are closed - semilunar values are opened	- AV values are opened - semilunar values are closed.	

the atria contracts for 0.1 sec and relaxes for 0.7
the ventricles contract for 0.3 sec and relaxes for 0.5

Heart Sounds:-

heard by stethoscope.

the heart sound is produced when the heart values are closed

lub	dub
- First heart sound - Produced when the AV values are closed - in ventricular contraction - higher than dub - cause by the back flow of blood in the ventricles when contracting. - to prevent the blood from entring the atria.	- second heart sound. - produced when the semi lunar values are closed - after the passage of the blood in the aorta and pulmonary. - lower then dub. - caused by the recoiling of the artries which cause a back flow of blood to the heart. - to prevent the blood from going to the ventricles. - happens because of the difference in capacity between ventricles and artries, the amount of blood and the expansion and recoiling of the artries.

Pulses:- is a pressure wave happen because of alternate expansion

lower the force of the ~~blood co~~ heart contraction, the more difficult the function of the organs.

- the further we go from the heart, the lower the expansion and recoiling. until we reach blood capillaries it will be the minimum blood pressure and it reaches zero in the end of the vena cava just before the right atrium.

- the minimum the pressure, the minimum the pulses, there will be no muscles (capillaries)

- pulses give indication about how the heart and artries work.

- Conduction System of the heart:-

The heart muscle contracts by depolarization which is done by:-

depolarization is, a reversal of the electrical polarity that normally exists across the plasma membrane.

① sinoatrial node (SA node) (stimulate the atria and AV node)

it is a small cluster of cardiac ~~cell~~ muscle cells.

SA node acts as a pacemaker for the rest of the heart by producing depolarization impulses spontaneously at a rhythmic rate. each 0.8 of sec. which will reach to both atrium. simultaneously.

② Atrioventricular node (AV node)

on the bottom of the right atriam near the septum

- connected with the SA node and recieve its impulses
- cannot give impulses by itself.
- delay the signal for almost 0.1 sec. (because of the connective tissue)
- is located between a connective tissue)

③ bundle of his

branches from the septum to the walls of the ventricles

recieves impulses from AV node

both contraction happens at the same time

the spread of depolarization is possible because the cardiac muscles are electrically coupled by gap junction.

④ purkinje fibers which are branches from the bundle of his.

(10) the electromagnetic waves around the heart ~~equals~~ is 3 times around the brain.

- the main responsible for blood ~~pressure~~ volume is the plasma of the blood.

blood pressure :- the force of the blood exerted against walls of the blood vessels.

systolic BP = ventricular contractions = 120 mm.Hg
diastolic BP = ventricular relaxations = 80 mm.Hg.

normal BP = 120/80 mm.Hg
measured by sphygmomanometer.

The Blood Pressure depened on three factors :-

1- force of the heart muscle contraction (left ventricle)
* pressure is greater in systole and lower in diastole.

2- Total of blood volume (amount of the blood) :-
- depened on the water in the plasma
- decrease volume → decrease pressure
- increase volume → increase pressure.
- decrease volume by :- blood loss, watter loss.

2 hormones responsible for water ionic balance :-
aldosterone - antidiuretic hormone

3- Size of space inside blood vessels (diameter) :-
- the bigger the ~~art~~ vessel the lower the pressure

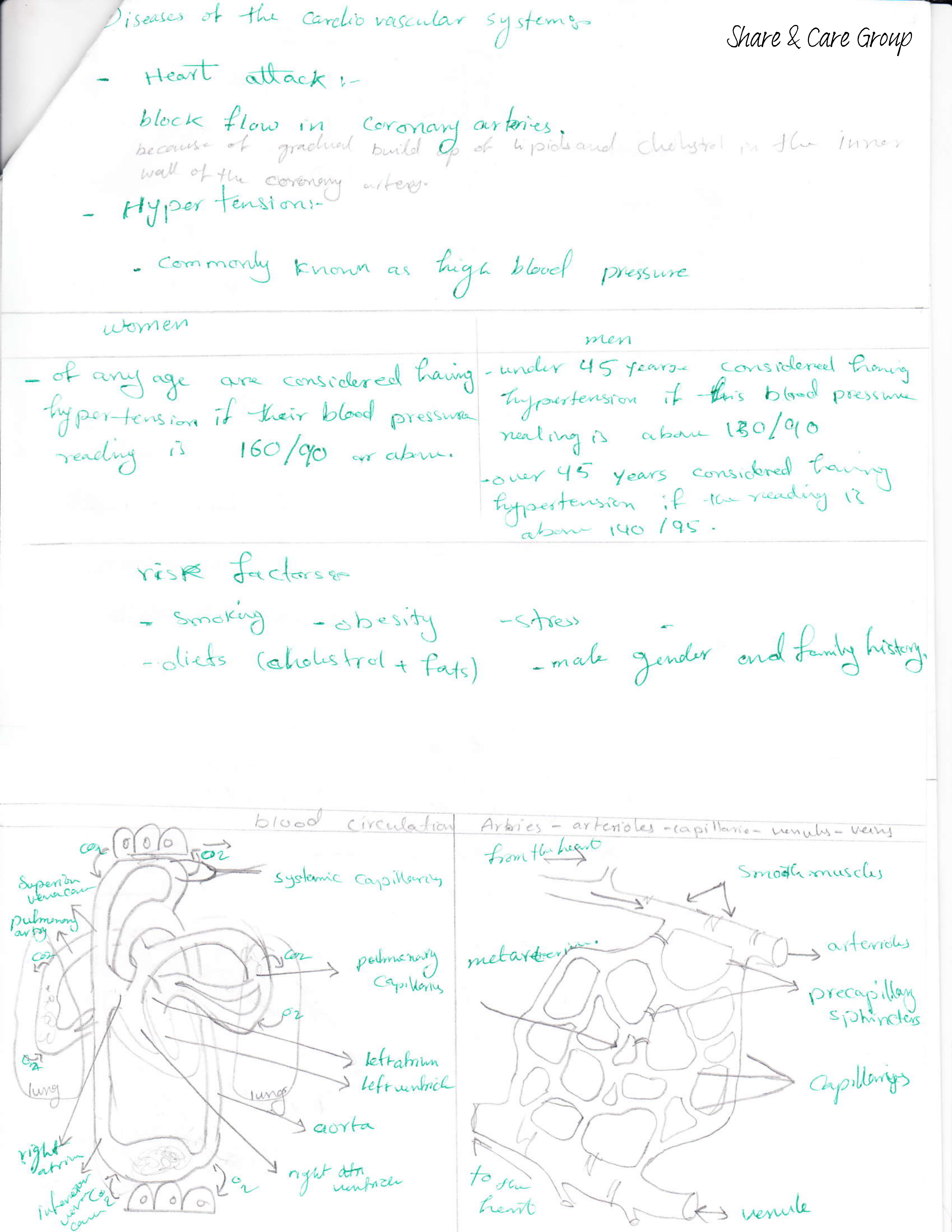
- first sound heard when the artery is open during pressure measuring is called Kortocof sound.

- cholestrol precipitate below the endothelium of veissels ~~causing~~ may cause a clott.

- Heart rate increase or decrease by neural regulation or increased by adrinaline

Blood pressure = blood flow x R.

100 : 100 ...



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Diseases of the cardio vascular systems:-

- Heart attack :-

block flow in coronary arteries.
because of gradual build up of lipids and cholystrol in the inner wall of the coronary artery.

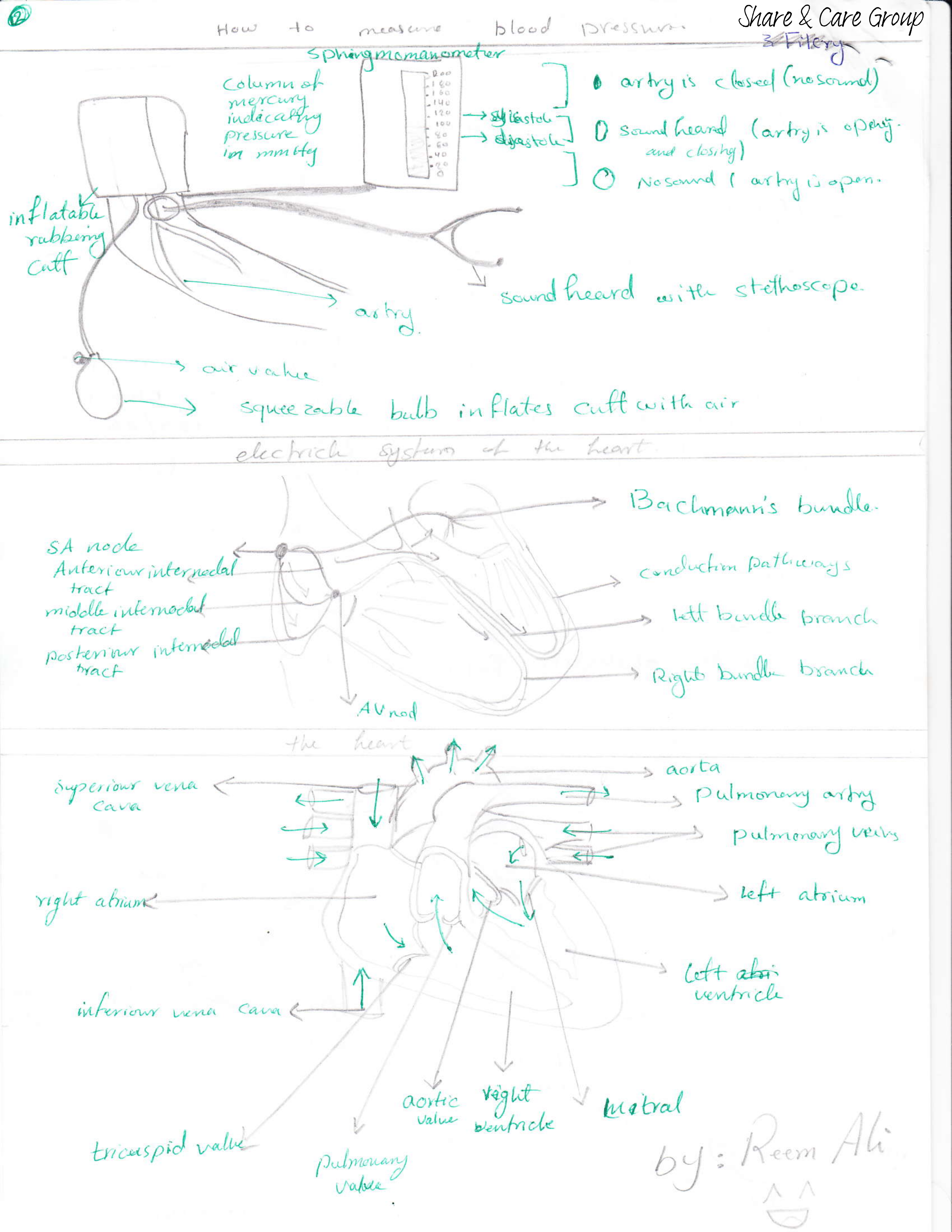
- Hypertension:-

- commonly known as high blood pressure

women	men
- of any age are considered having hyper-tension if their blood pressure reading is 160/90 or above.	- under 45 years:- considered having hypertension if this blood pressure reading is above 130/90 - over 45 years considered having hypertension if the reading is above 140/95.

risk factors:-

- smoking - obesity - stress
- diets (cholestrol + fats) - male gender and family history.



2
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How to measure blood pressure
Sphingmomanometer
Column of mercury indicating pressure in mm Hg
200
180
160
140
120
100
80
60
40
20
0
systole
diastole
artry is closed (no sound)
sound heard (artry is opening and closing)
No sound (artry is open.
inflatable rubbering cuff
sound heard with stethoscope.
artry.
air valve
squeezable bulb inflates cuff with air
electrich system of the heart
Bachmann's bundle.
SA node
Anteriour internodal tract
middle internodal tract
posteriour internodal tract
conduction pathways
left bundle branch
Right bundle branch
AV nod
the heart
aorta
superiour vena cava
pulmonary artry
pulmonary veins
right atrium
left atrium
left ventricle
inferiour vena cava
aortic valve
right ventricle
mitral
tricuspid valve
pulmonary valve
by: Reem Ali